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(57) Abstract

Unsaturated binder composition comprising at least one unsaturated monomer, at least one unsaturated polyester and preferably one or more crosslinking catalysts or the like. The monomer is preferably an ester of at least one carboxylic acid or anhydride and at least one alcohol or an adduct thereof and includes in its molecule at least one reactive aliphatic unsaturation, which can be corsslinked with the unsaturation within the polyester. The polyester is a dendritic or hyperbranched macromolecule comprising a nucleus having at least one reactive hydroxyl or epoxide group and anumber of generations of at least one chain extender having at least two hydroxyl groups and at least one carboxyl group. The macromolecule is completely or partially in one or more steps chain terminated by at least one chain terminator being a carboxyfunctional unsaturated ester, a saturated or unsaturated carboxylic acid or by allylation.

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UNSATURATED BINDER COMPOSITION

The present invention relates to a binder composition comprising at least one unsaturated monomer, at least one unsaturated polyester and preferably one or more crosslinking catalysts and/or crosslinking initiators and/or similar additives. The polyester is a chain terminated hyperbranched or dendritic macromolecule and unsaturation within the monomer can be crosslinked with unsaturation within the polyester.

Unsaturated polyesters are curing and/or drying high molecular compounds used for i.a. composites, paints, lacquers and similar binders and can roughly be divided into conventional polyesters and dendritic or hyperbranched macromolecules of polyester type.

Conventional unsaturated polyesters are mainly based on unsaturated and saturated carboxylic acids, such as maleic acid, fumaric acid, *o*-phthalic acid, tetrahydrophthalic acid, isophthalic acid, adipic acid, which are esterified with alcohols, preferably aliphatic saturated diols, such as ethylene glycol, propylene glycol, neopentyl glycol. Unsaturated alcohols, for example allyl ethers of trimethylolpropane or pentaerythritol, can also be included as well as minor amounts of polyfunctional alcohols.

Dendritic and hyperbranched macromolecules of polyester type are three dimensional molecules having a tree-like structure and are composed of a nucleus or initiator molecule having one or more reactive groups, preferable amine, hydroxyl or epoxide groups, to which one or more generations of a chain extender, such as saturated or unsaturated hydroxyfunctional carboxylic acids or reaction products thereof, are added. A macromolecule according to above can furthermore be chain terminated by for instance a saturated or unsaturated carboxylic acid or alcohol. Unsaturated polyesters having so high a molecular weight that good properties are obtained, but so low a viscosity that conventional solvents are unnecessary to add in order to obtain practical viscosities, can be prepared if the polyester is formulated as a dendritic or hyperbranched macromolecule.

Crosslinking of unsaturated polyesters are performed by means of addition of various catalysts, such as peroxides and cobalt salts, or initiators for ultraviolet (UV) infrared (IR) or electron beam (EB) curing. A three dimensional structure is obtained through crosslinking of unsaturation within the polyester. Even if direct crosslinking of the unsaturation within the polyester is possible, the obtained three dimensional crosslinked matrix often gives unfavourable properties, such as poor

through cure, poor resistance etc. The crosslinking is usually aided by vinyl monomers, normally consisting of only styrene or wherein styrene is the main component. The polyester is thereby dissolved in and mixed with the monomer and constitutes normally 40-80% of the thus obtained binder composition. Compounds such as styrene are, in addition to being monomers, viscosity reducing, whereby high molecular and hence high viscous conventional unsaturated polyesters obtain a practical viscosity.

A variety among unsaturated polyesters are various acrylic oligomers of polyester type, i.e. polyesters wherein the unsaturation is derived from acrylic or methacrylic acid. Crosslinking is in these systems usually performed by means of an acrylic monomers, i.e. esters of mono, di, tri or polyfunctional alcohols and acrylic or methacrylic acid.

The large amounts of mainly styrene, used for crosslinking of unsaturated polyesters, has for a long time been subject to discussions and trials to eliminate or minimise the use has during the last years become more and more immediate. Most vinyl monomers are more or less injurious to the environment and/or hazardous to the health. Styrene is an inflammable liquid, with pungent odour, which at inhalation or vapour contact gives rise to nasal and pharyngeal burn, tear flow, headache, fatigue, nausea, vertigo, inflamed eyelids and at higher amounts respiratory disorders and unconsciousness. Long-term and repeated exposure to styrene can decrease the reaction ability and the memory. Furthermore, styrene degreases the skin and can cause blush, skin crack, blistering and eczema. Mutagenic effect of styrene (mainly metabolites) has been proven in genetic tests. Chromosomal anomaly has in some cases been proven in exposed persons. It can also be mentioned that the hygienic limit for styrene is as low as 25 ppm.

Another problem at the use of vinyl monomers is that these polymerise, however slowly, already at room temperature. The polymerisation is rapid under influence of light, air, heat, alkali metals and peroxides. Styrene for instance polymerises very rapidly under a heavy exotherm at temperatures above 50°C. This tendency to polymerisation reduces substantially the storage stability of unsaturated polyesters dissolved in and mixed with for instance styrene in comparison to the storage stability of the polyester per se. Vinyl polymers are, in order not to polymerise during employment, normally stabilised using various inhibitors, which per se can cause environmental and heath hazards and/or interact with the crosslinking mechanism of unsaturated polyesters.

The trials made to reduce or eliminate the use of mainly styrene have substantially meant that various types of conventional branched and linear polyester has been formulated especially to be possible to crosslink with acceptable result without monomers. These trials have most often resulted in compromises with regard to the various properties, such as the relations between curing time, through cure, hardness, flexibility, resistance, molecular weight, viscosity etc. Non-reactive solvents, such as acetates, alcohols etc., have often been added to obtain practical viscosities. These additions of solvents are from many aspects unsuitable. They give for instance rise to undesirable environmental, health and pratical problems. Coating and curing equipment is for instance not suitable or intended to be exposed to volatile solvents. In order to avoid contact between solvent vapours and high energy equipment, such as UV lamps and the like, the solvent in which the polyester is dissolved must be allowed to vaporise prior to curing, which depending on type of solvent, type of polyester and type of application can be a substantial bottle-neck in a production chain.

It has through the present invention quite unexpectedly been possible to eliminate above disclosed problems and produce an unsaturated binder composition, being entirely free of vinyl monomers of the styrene type, having good to excellent properties. The binder composition can, furthermore, in most cases be used without any addition of diluting solvents. The present invention provides a binder composition without waiving such properties as coating quality, final hardness, through cure, residual unsaturation, flexibility, impact resistance, hydrolytic stability etc.

The binder composition according to the present invention comprises at least one unsaturated monomer, at least one unsaturated polyester and preferably one or more crosslinking catalysts, crosslinking initiators and/or similar additives. The unsaturation within the monomer is crosslinked with the unsaturation within the polyester. The binder composition is characterised in

a) that the monomer is
   - (i) an ester of at least one di, tri or polyfunctional aliphatic, cycloaliphatic or aromatic carboxylic acid or, where applicable, corresponding anhydride and at least one monofunctional aliphatic, cycloaliphatic or aromatic alcohol,
   - (ii) an ester of at least one linear aliphatic monofunctional carboxylic acid having more than 3 carbon atoms, a branched aliphatic monofunctional carboxylic acid having more than 4 carbon atoms, a cycloaliphatic or aromatic monofunctional carboxylic acid and at least one mono, di, tri or polyfunctional aliphatic, cycloaliphatic or aromatic alcohol,

(iii) an ester of a linear aliphatic monofunctional carboxylic acid having more than 3 carbon atoms, a branched aliphatic monofunctional carboxylic acid having more than 4 carbon atoms, a cycloaliphatic or aromatic monofunctional carboxylic acid and a monofunctional aliphatic, cycloaliphatic or aromatic alcohol,

(iv) a carboxyfunctional allyl ether or an ester thereof,

(v) an adduct between at least one carboxyfunctional compound according to (i) or (iv) and at least one di, tri or polyfunctional aliphatic, cycloaliphatic or aromatic alcohol,

(vi) an adduct between at least one hydroxyfunctional compound according to (ii) or (iv) and at least one di, tri or polyfunctional aliphatic, cycloaliphatic or aromatic carboxylic acid or, where applicable, corresponding anhydride,

whereby the unsaturation within the monomer is derived from a carboxylic acid, an anhydride, an allyl ether and/or an alcohol; and

b) that the polyester is a dendritic or hyperbranched macromolecule comprising a nucleus having at least one reactive hydroxyl or epoxide group to which 1-100, preferably 1-20, generations of at least one monomeric or polymeric chain extender having at least two reactive hydroxyl groups and at least one reactive carboxyl group, are added, whereby a hyperbranched or dendritic macromolecule wherein terminal groups substantially are hydroxyl groups is yielded, which macromolecule completelt or partially in one or more steps is chain terminated

(i) by at least one chain terminator being a carboxyfunctional unsaturated ester of at least one di, tri or polyfunctional carboxylic acid or, where applicable, corresponding anhydride and at least one monofunctional alcohol, and/or

(ii) by a complete or partial allylation of the terminal hydroxyl groups of the macromolecule and optionally

(iii) by at least one chain terminator being a monofunctional saturated or unsaturated carboxylic acid or, where applicable, corresponding anhydride,

whereby the unsaturation within the polyester completely or partially is derived from the chain termination.

The, in the binder composition according to the present invention, included monomer is in various embodiments of the general formula

$$(R_1 - O - R_4)_n - R_2 - (R_4 - O - R_3)_m$$

wherein n and m independently is 1, 2 or 3 and wherein R_1 is hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof, R_2 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof, R_3 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof and

wherein R_4 is $\overset{\displaystyle O}{\overset{\|}{C}}$ or $\begin{array}{c} H \\ | \\ C \\ | \\ H \end{array}$

whereby at least one substituent R_1, R_2 or R_3 comprises at least one aliphatic double bond.

R_2 can, in the embodiment wherein R_4 is $\overset{\displaystyle O}{\overset{\|}{C}}$, be carboxysubstituted alkyl, alkenyl alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof and R_1 can be hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched and/or hydroxysubstituted variations thereof.

R_3 can, furthermore, in this embodiment be

$R_5 - O - \overset{\displaystyle O}{\overset{\|}{C}} - R_6 - \overset{\displaystyle O}{\overset{\|}{C}} - O - R_7$ wherein R_5 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof, R_6 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched and/or hydroxysubstituted variations thereof and R_7 is hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof.

R_2 can, in the alternative embodiment wherein R_4 is CH_2, be hydroxysubstituted alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched and/or carboxysubstituted variations thereof.

R_3 can, furthermore, in this embodiment be $R_5 - O - CH_2 - R_6 - CH_2 - O - R_7$ wherein R_5 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof, R_6 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl,

alkynylaryl and/or branched and/or carboxysubstituted variations thereof and R_7 is hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof.

The monomer is, in a preferred embodiment of the present invention, an ester of a mono or difunctional carboxylic acid or, where applicable, its anhydride and a monofunctional alcohol, the molar ratio between carboxylic acid and alcohol being 1:0.8 to 1:1.2. The carboxylic acid or the anhydride is preferably maleic anhydride, fumaric acid, succinic anhydride, adipic acid, propionic acid, acetic acid, crotonic acid, caprylic acid or capric acid while the alcohol preferably is trimethylolpropane diallyl ether, pentaerythritol triallyl ether, 5-methyl-1,3-dioxane-5-methanol, methanol, ethanol, propanol or butanol. The monomer thereby comprises at least one aliphatic double bond.

The monomer is in a further embodiment an adduct between
(a) an ester of maleic anhydride or fumaric acid and a monofunctional alcohol, such as methanol, ethanol, propanol, butanol or 1,3-dioxane or allyl ether monoalcohols and
(b) a diol, whereby the diol is ethylene glycol, propylene glycol, butylene glycol, neopentyl glycol, 2-methyl-1,3-propanediol, 2-ethyl-2-butyl-1,3-propanediol, 1,3-dioxane-5,5-dimethanol, cyclohexanedimethanol, trimethylolpropane monoallyl ether and/or phenylethylene glycol.

The molar ratio ester (a) to diol (b) is in these embodiments 0.8:1 to 2.2:1.

The monomer is, in yet a further embodiment, an adduct between
(a) an ester of maleic anhydride or fumaric acid and an aliphatic monofunctional alcohol, such as methanol, ethanol, propanol or butanol,
(b) a diol and
(c) a monofunctional carboxylic acid.

The diol in above embodiment is preferably ethylene glycol, propylene glycol, butylene glycol, neopentyl glycol, 2-methyl-1,3-propanediol, 2-ethyl-2-butyl-1,3-propanediol, cyclohexanedimethanol, 1,3-dioxane-5,5-dimethanol, trimethylol-propane monoallyl ether or phenylethylene glycol while the carboxylic acid preferably is crotonic acid, caprylic acid or capric acid. The molar ratio ester to diol to acid is 1:0.8:0.8 to 1:1.2:1.2.

The monomer is in certain embodiments 2,2-dimethylolpropionic acid monoallyl ether or 2,2-dimethylolpropionic acid diallyl ether or an ester thereof and for instance trimethylolpropane diallyl ether or pentaerythritol triallyl ether at a molar

ratio 1:0.8 to 1:1.2. The monomer can alternatively be an ester of 2,2-dimethylolpropionic acid monoallyl ether or 2,2-dimethylolpropionic acid diallyl ether and a diol at a molar ratio 0.8:1 to 2.2:1, the diol being ethylene glycol, propylene glycol, butylene glycol, neopentyl glycol, 2-methyl-1,3-propanediol, 2-ethyl-2-butyl-1,3-propanediol, cyclohexane dimethanol, 1,3-dioxane-5,5-dimethanol, trimethylolpropane monoallyl ether or phenylethylene glycol.

The choice of compounds included in the monomer, the degree of unsaturation, the location of the unsaturation within the molecule and the viscosity as well as the amount of monomer influence to a varying extent the properties of the binder composition according to the present invention. Best properties are in most cases obtained if the binder composition comprises 20-90, preferably 40-70, per cent by weight of monomer and when the molecular weight of the monomer is at most 1000.

The binder composition according to the present invention comprises, besides disclosed monomer, at least one unsaturated polyester of the type hyperbranched or dendritic macromolecule being chain terminated by at least one unsaturated ester and optionally at least one saturated or unsaturated monofunctional carboxylic acid. The chain terminator of said polyester is, in a preferred embodiment, an ester having the general formula

$$HO - \overset{O}{\overset{\|}{C}} - R_1 - \overset{O}{\overset{\|}{C}} - O - R_2$$

wherein R_1 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched and/or carboxysubstituted variations thereof and wherein R_2 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof, whereby at least one substituent R_1 or R_2 comprises at least one aliphatic double bond.

The chain terminator of the polyester is in a preferred embodiment an ester of maleic acid, maleic anhydride, fumaric acid, succinic acid or succinic anhydride and 5-methyl-1,3-dioxane-5-methanol, 5-ethyl-1,3-dioxane-5-methanol, trimethylolpropane diallyl ether, pentaerythritol triallyl ether and/or a lower alcohol such as methanol, ethanol, butanol or propanol at a molar ratio acid to alcohol of 1:0.8 to 1:1.2.

It is also possible and in certain embodiments suitable to chain terminate the polyester by a complete or partial allylation, by reaction with for instance allylchloride and/or allylbromide, of its terminal hydroxyl groups.

The acid is, in an embodiment of the present invention, according to which the chain terminator is a monofunctional carboxylic acid, preferably acetic acid, propionic acid, butyric acid, isobutyric acid, valeric acid, trimethylacetic acid, crotonic acid, acrylic acid, methacrylic acid, benzoic acid, para-tert.butylbenzoic acid, capric acid, caprylic acid, caproic acid, heptanoic acid, 2-ethylhexanoic acid, pelargonic acid, isononanoic acid, lauric acid, myristic acid, palmitic acid, stearic acid, isostearic acid, behenic acid, lignoceric acid, montanoic acid, sorbic acid, abietic acid, oleic acid, ricinoleic acid, linoic, linoleic acid, soybean fatty acid, linseed fatty acid, dehydrated castor fatty acid, tall oil fatty acid, tung oil fatty acid, sunflower fatty acid, safflower fatty acid and/or 2,2-dimethylolpropionic acid diallyl ether.

The binder composition according to the present invention comprises, besides monomer and polyester, preferably one or more crosslinking catalysts, crosslinking initiators and/or similar additives, each in an amount of 0.1-15, preferably 1-10, per cent by weight calculated on included polyester. Crosslinking catalysts and crosslinking initiators are suitably

(a) benzoephenones such as alkyl and haloalkylbenzoephenones,
(b) antraquinones such as nitroantraquinones, antrahydroquinones and derivatives thereof,
(c) benzoin and derivatives thereof,
(d) acetophenone and derivatives thereof,
(e) acyloxime esters and derivatives thereof,
(f) benzil ketals and derivatives thereof,
(g) peroxides such as hydrogen peroxide, methylethylketone peroxide, methylisobutylketone peroxide, cumenhydroperoxide and benzoyl peroxide,
(h) metal salts such as octoates, naphthenates and oleates of cobalt and manganese,
(i) perbenzoates such as alkylperbenzoates,
(j) cathecols such as alkylcathecols and/or
(k) phenylamines such as aniline, alkylanilines, toluidine and alkyltoluidines.

The binder composition constitutes in various embodiments 1-100, preferably 20-100 and most preferably 50-100, per cent by weight of an air drying, heat curing or radiation curing paint or lacquer intended for industrial surface treatment of for instance paper, wood, plastics and/or steel, such as a printing ink, a

furniture coating, an automotive coating, a coating for domestic appliances or a microlithographic resist/coating.

The binder composition can, furthermore, advantageously be included in or be an adhesive.

The monomer included in the binder composition according to the present invention is especially suitable for use with dendritic or hyperbranched macromolecules, but provides excellent results with all types of unsaturated polyesters substituting or supplementing various vinyl and acrylic monomers.

The present invention will now be further disclosed by means of enclosed embodiment examples 1-22, wherein the examples disclose

Example 1:	Preparation of a 2-generation hyperbranched polyester.
Example 2:	Preparation of an alkyl terminated saturated polyester from the product obtained in Example 2.
Example 3:	Preparation of a carboxyfunctional ester of trimethylolpropane diallyl ether and maleic anhydride.
Example 4:	Preparation of a carboxyfunctional ester of trimethylolpropane diallyl ether and succinic anhydride.
Example 5:	Preparation of a carboxyfunctional ester of maleic anhydride and ethanol
Example 6:	Preparation of an unsaturated polyester from the products obtained in Examples 2 and 3.
Example 7:	Preparation of an unsaturated polyester from the products obtained in Examples 2 and 4.
Example 8:	Preparation of an unsaturated polyester from the products obtained in Examples 2 and 5.
Example 8:	Preparation of an ester of trimethylolpropane diallyl ether and succinic anhydride.
Example 10:	Binder composition comprising the products obtained in Examples 3, 5 and 6.
Example 11:	Binder composition comprising the products obtained in Examples 3, 5 and 7.
Example 12:	Binder composition comprising the products obtained in Examples 3, 5 and 8.
Examples 13-15:	Binder compositions comprising the products obtained in Examples 3, 5 and 9.
Example 16:	Evaluation in lacquers of the binder compositions according to Examples 1-15.

Example 17:	Preparation of an alkyl terminated saturated polyester from the product obtained in Example 1.
Example 18	Preparation of an unsaturated polyester from the products obtained in Examples 3 and 17.
Examples 19-20:	Binder compositions comprising the products obtained in Examples 3, 5 and 18.
Example 21:	Evaluation in lacquers of the binder compositions according to Examples 19 and 20.
Example 22:	Evaluation in UV curing lacquers of the binder compositions according to Examples 11 and 14

The invention is not limited to shown embodiments as these with regard to for instance the molecular composition of the monomer as well as the polyester, degree of unsaturation and hence the binder composition, can be modified within the scope of the invention.

Example 1

308.9 g (0.85 mole) Polyol PP 50 (ethoxylated pentaerythritol, Perstorp Polyols), 460.5 g (3.42 moles) of 2,2-dimethylolpropionic acid and 0.46 g (0.004 mole) H_2SO_4 (96%) were charged in a 4-necked reaction flask provided with a stirrer, cooler, manometer and distillation receiver. The equipment was furthermore connected to a vacuum pump. The mixture was heated to 120°C, whereby water formation commenced and 2,2-dimethylolpropionic acid began to melt. The temperature was after 20 minutes 140°C and a clear solution was obtained. The pressure was reduced from atmospheric pressure to 20-30 mm Hg and the reaction was allowed to continue under heavy stirring for 240 minutes until an acid value of 7.0 mg KOH/g was obtained. 460.5 g (6.84 moles) of 2,2-dimethylolpropionic acid and 0.7 g (0.007 mole) of H_2SO_4 (96%) was added to the reaction mixture during 10 minutes. A clear solution was after a further 25 minutes obtained, whereby the pressure once again was reduced to 20-30 mm Hg and the reaction allowed to continue for 210 minutes until an acid value of 10.2 mg KOH/g was obtained.

Obtained hyperbranched polyester was analysed with regard to hydroxyl value and molecular weight. The result is given below:

Acid value, mg KOH/g:	10.2
Hydroxyl value, mg KOH/g:	500
Theoretical hydroxyl value, mg KOH/g:	511
Molecular weight, g/mole:	1824
Theoretical molecular weight, g/mole:	1748

Example 2

830.0 g of the hyperbranched polyester obtained in Example 1, 677.7 g (4.59 moles) of a mixture of caprylic and capric acid, 2.0 g (0.03 mole) of $Ca(OH)_2$ and 75 g of xylene were charged in a 4-necked reaction flask provided with a stirrer, nitrogen inlet, a Dean-Stark receiver and a cooler. The reaction mixture was during 50 minutes heated to 170°C, whereby water began to evaporate. The reaction mixture was now during 120 minutes heated from 170°C to 210°C, corresponding to a temperature gradient of 0.3°C/minute. The reaction was under stirring allowed to continue for 510 minutes until an acid value of 5.6 mg KOH/g was obtained. Xylene was removed by applying full vacuum for approx. 20 minutes.
Obtained product was analysed with regard to acid value, hydroxyl value, viscosity, non-volatile content and colour. The result is given below:

Final acid value, mg KOH/g:	4.2
Hydroxyl value, mg KOH/g:	111
Theoretical hydroxyl value, mg KOH/g:	111
Viscosity, 23°C, mPas:	16200
Non-volatile content, %:	99.3
Colour, Gardner:	4

Example 3

502.2 g (2.30 moles) of trimethylolpropane diallyl ether and 202.9 g (2.07 moles) of maleic anhydride were charged in a 4-necked reaction flask provided with a magnetic stirrer, nitrogen inlet and a cooler. The reaction mixture was during 120 minutes heated to 82°C, whereby an exothermic reaction was observed. The solution was, when the exotherm had decreased, heated to 90°C and kept at this temperature for 120 minutes and then cooled.

Analysis of obtained ester/monomer gave the following values:

Acid value, mg KOH/g:	169
Theoretical acid value, mg KOH/g:	165
Viscosity, 23°C, mPas:	127
Colour, Gardner:	< 1

Example 4

502.2 g (2.30 moles) of trimethylolpropane diallyl ether and 207.0 g (2.07 moles) of succinic anhydride were charged in a 4-necked reaction flask provided with a magnetic stirrer, nitrogen inlet and a cooler. The reaction mixture was during 120 minutes heated to 130°C and kept at this temperature for 120 minutes and then cooled.

Analysis of obtained ester/monomer gave the following values:

Acid value, mg KOH/g:	164
Theoretical acid value, mg KOH/g:	164
Viscosity, 23°C, mPas:	124
Colour, Gardner:	1

Example 5

506.0 g (11.00 moles) of ethanol and 215.6 g (2.20 moles) of maleic anhydride were charged in a 4-necked reaction flask provided with a magnetic stirrer, nitrogen inlet and a cooler. The reaction mixture was during 120 minutes heated to 80°C and kept at this temperature for 100 minutes, whereafter excess of ethanol was evaporated by vacuum distillation.

Analysis of obtained ester/monomer gave the following values:

Acid value, mg KOH/g:	368
Theoretical acid value, mg KOH/g:	390
Viscosity, 23°C, mPas:	46
Colour, Gardner:	< 1

Example 6

400.0 g of the polyester according to Example 2, 174.6 g of the ester according to Example 3, 1.4 g (0.014 mole) of H_2SO_4 (96%) and 57 g of heptane were charged in a 4-necked reaction flask provided with a stirrer, nitrogen inlet, a Dean-Stark receiver and a cooler. The reaction mixture was during 45 minutes heated to 120°C, whereby water began to evaporate. The reaction was under stirring at 120°C allowed to continue for 780 minutes until an acid value of 10.0 mg KOH/g was obtained. 3.0 g of $Ca(OH)_2$ was now added and heptane removed by applying

full vacuum for approx. 20 minutes, whereafter obtained product was pressurised and filtered.

Obtained hyperbranched unsaturated polyester was analysed with regard to acid value, viscosity, non-volatile content and colour. The result is given below:

Final acid value, mg KOH/g:	8.5
Viscosity, 23°C, mPas:	26900
Non-volatile content, %:	95.9
Colour, Gardner:	4-5

Example 7

400.0 g of the polyester according to Example 2, 180.0 g of the ester according to Example 4, 1.4 g (0.014 mole) of H_2SO_4 (96%) and 58 g of heptane were charged in a 4-necked reaction flask provided with a stirrer, nitrogen inlet, a Dean-Stark receiver and a cooler. The reaction mixture was during 30 minutes heated to 120°C, whereby water began to evaporate. The reaction was under stirring at 120°C allowed to continue for 390 minutes until an acid value of 8.1 mg KOH/g was obtained. 3.0 g of $Ca(OH)_2$ was now added and heptane removed by applying full vacuum for approx. 20 minutes, whereafter obtained product was pressurised and filtered.

Obtained hyperbranched unsaturated polyester was analysed with regard to acid value, viscosity, non-volatile content and colour. The result is given below:

Final acid value, mg KOH/g:	4.9
Viscosity, 23°C, mPas:	13800
Non-volatile content, %:	96.8
Colour, Gardner:	5

Example 8

400.0 g of the polyester according to Example 2, 80.2 g of the ester according to Example 5, 1.4 g (0.14 mole) of H_2SO_4 (96%) and 48 g of heptane were charged in a 4-necked reaction flask provided with a stirrer, nitrogen inlet, a Dean-Stark receiver and a cooler. The reaction mixture was during 20 minutes heated to 120°C, whereby water began to evaporate. The reaction was under stirring at 120°C allowed to continue for 165 minutes until an acid value of 24.7 mg KOH/g was obtained. 3.0 g of $Ca(OH)_2$ was now added and heptane removed by applying

full vacuum for approx. 20 minutes, whereafter obtained product was pressurised and filtered.

Obtained hyperbranched unsaturated polyester was analysed with regard to acid value, viscosity, non-volatile content and colour. The result is given below:

Final acid value, mg KOH/g:	20.8
Viscosity, 23°C, mPas:	30000
Non-volatile content, %:	93.9
Colour, Gardner:	4

Example 9

611.3 g (2.80 moles) of trimethylolpropane diallyl ether, 133.0 g (1.33 mole) of succinic anhydride and 37 g of toluene were charged in a 4-necked reaction flask provided with a stirrer, nitrogen inlet, a Dean-Stark receiver and a cooler. The reaction mixture was during 30 minutes heated to 130°C and 0.7 g (0.007 mole) H_2SO_4 (96%) charged. The solution was during a further 5 minutes heated until a temperature of 160°C was obtained and water began to evaporate. The reaction was allowed to continue at this temperature for 155°C until an acid value of 6.2 mg KOH/g was obtained. 2.0 g $Ca(OH)_2$ was now added and toluene removed by applying full vacuum for approx. 20 minutes, whereafter obtained product was pressurised and filtered.

Obtained polyester/monomer was analysed with regard to acid value, viscosity and colour. The result is given below:

Final acid value, mg KOH/g:	5.9
Viscosity, 23°C, mPas:	58
Colour, Gardner:	2-3

Example 10

The products prepared according to Examples 3, 5 and 6 were mixed giving the following composition by weight:

Unsaturated polyester according to Example 6:	21.0%
Monomer according to Example 3:	39.9%
Monomer according to Example 5:	39.1%

Obtained binder composition exhibited a viscosity of 190 mPas at 25°C.

Example 11

The products prepared according to Examples 3, 5 and 7 were mixed giving the following composition by weight:

Unsaturated polyester according to Example 7:	17.7%
Monomer according to Example 3:	40.8%
Monomer according to Example 5:	41.5%

Obtained binder composition exhibited a viscosity of 130 mPas at 25°C.

Example 12

The products prepared according to Examples 3, 5 and 8 were mixed giving the following composition by weight:

Unsaturated polyester according to Example 8:	15.7%
Monomer according to Example 3:	38.0%
Monomer according to Example 5:	46.3%

Obtained binder composition exhibited a viscosity of 130 mPas at 25°C.

Example 13

The products prepared according to Examples 5, 7 and 9 were mixed giving the following composition by weight:

Unsaturated polyester according to Example 7:	20.0%
Monomer according to Example 9:	28.9%
Monomer according to Example 5:	51.1%

Obtained binder composition exhibited a viscosity of 90 mPas at 25°C.

Example 14

The products prepared according to Examples 5, 7 and 9 were mixed giving the following composition by weight:

Unsaturated polyester according to Example 7: 40.0%
Monomer according to Example 9: 17.7%
Monomer according to Example 5: 42.3%

Obtained binder composition exhibited a viscosity of 270 mPas at 25°C.

Example 15

The products prepared according to Examples 5, 7 and 9 were mixed giving the following composition by weight:
Unsaturated polyester according to Example 7: 60.0%
Monomer according to Example 9: 6.6%
Monomer according to Example 5: 33.4%

Obtained binder composition exhibited a viscosity of 820 mPas at 25°C.

Example 16

Lacquers were, from the binder compositions according to Examples 10-15, prepared giving the following composition:

Composition according to Example 10-15:	100.00 g
Cobalt octoate, 10% Co:	1.00 g
Dimethyl-*p*-toluidine, 10%:	2.80 g
Butylperbenzoate:	2.70 g
Methylethylketone peroxide, 50%:	2.70 g
Levelling agent (BYK 320):	0.40 g

Obtained lacquers were at a filmthickness of 35 ± 5 µm, calculated as dry film, coated on glass panels and cured at 100°C.

The result is given in tables below.

Properties:

Lacquer according to Example	10	11	12	13	14	15
Viscosity, 25°C, mPas	190	130	120	90	270	820
Non-volatile content, %	100	100	100	100	100	100

Curing at 100°C (pendulum hardness according to König):

Lacquer according to Example	10	11	12	13	14	15
10 min., König seconds	36	39	34	17	15	15
20 min., König seconds	108	111	99	74	24	17
30 min., König seconds	111	113	109	81	25	17
40 min., König seconds	118	120	116	85	27	17
50 min., König seconds	127	123	116	91	27	17

Example 17

535.5 g of the hyperbranched polyester obtained in Example 1, 175.4 g (2.36 moles) of propionic acid and 75 g of xylene were charged in a 4-necked reaction flask provided with a stirrer, nitrogen inlet, a Dean-Stark receiver and a cooler. The reaction mixture was during 25 minutes heated to 130°C, whereby water began to evaporate. The reaction was allowed to continue at this temperature for 360 minutes until an acid value of 11.6 mg KOH/g was obtained. Xylene was now removed by applying full vacuum for approx. 20 minutes.

Obtained alkyl terminated hyperbranched polyester was analysed with regard to acid value, hydroxyl value and non-volatile content. The result is given below:

Final acid value, mg KOH/g:	20.6
Hydroxyl value, mg KOH/g:	225
Theoretical hydroxyl value, mg KOH/g:	204
Non-volatile content, %:	99.7

Example 18

250.0 g of the polyester obtained in Example 17, 278.9 g of the ester obtained in Example 3, 0.35 g (0.003 mole) of H_2SO_4 (96%) and 50 g of toluene were charged in a 4-necked reaction flask provided with a stirrer, nitrogen inlet, a Dean-Stark receiver and a cooler. The reaction mixture was during 50 minutes heated to 130°C, whereby water began to evaporate. The reaction mixture was under stirring at 130°C allowed to continue for 300 minutes until an acid value of 26.0 mg KOH/g was obtained. 3.0 g $Ca(OH)_2$ was now added and toluene removed by applying full vacuum for approx. 20 minutes, whereafter obtained product was pressurised and filtered.

Obtained hyperbranched unsaturated polyester was analysed with regard to acid value, hydroxyl value, non-volatile content and colour. The result is given below:

Final acid value, mg KOH/g:	25.2
Non-volatile content, %:	98.9
Colour, Gardner:	3-4

Example 19

The products prepared according to Examples 3, 5 and 18 were mixed giving the following composition by weight:

Unsaturated polyester according to Example 18:	62.1%
Monomer according to Example 3:	20.6%
Monomer according to Example 5:	17.3%

Obtained binder composition exhibited a viscosity of 1900 mPas at 25°C

Example 20

The products prepared according to Examples 3, 5 and 18 were mixed giving the following composition by weight:

Unsaturated polyester according to Example 18:	36.3%
Monomer according to Example 3:	30.2%
Monomer according to Example 5:	33.5%

Obtained binder composition exhibited a viscosity of 400 mPas at 25°C.

Example 21

Lacquers were, from the binder compositions according to Examples 19 and 20, prepared giving the following composition:

Composition according to Example 19-20:	100.00 g
Cobalt octoate, 10% Co:	1.00 g
Dimethyl-*p*-toluidine, 10%:	2.80 g
Butylperbenzoate:	2.70 g
Methylethylketone peroxide, 50%:	2.70 g
Levelling agent (BYK 320):	0.40 g

Obtained lacquers were at a filmthickness of 35 ± 5 µm, calculated as dry film, coated on glass panels and cured at 100°C.

The result is given in tables below.

Properties:

Lacquer according to Example	19	20
Viscosity, 25°C, mPas	190	130
Non-volatile content, %	100	100

Curing at 100°C (pendulum hardness according to König):

Lacquer according to Example	19	20
10 min., König seconds	57	66
20 min., König seconds	70	87
30 min., König seconds	91	91
40 min., König seconds	115	106
50 min., König seconds	92	111

<u>Example 22</u>

UV (ultraviolet) curing lacquers were, from the products according to Examples 11 and 14, prepared giving the following composition:

Composition according to Example 11 or 14:	100.00 g
Photoinitiator (Darocure 1173):	4.00 g

The lacquers were at a filmthickness of 30 ± 5, calculated as dry film, coated on glass panels and curing by means of an equipment comprising a UV-lamp, having an effect of 80 W/cm, and conveyor belt, having a belt speed of 12.5 m/minute.

The result is given in tables below.

Properties:

Lacquer according to Example	11	14
Viscosity, 25°C, mPas	130	270
Non-volatile content, %	100	100

UV curing - Number of passages under the UV lamp (pendulum hardness according to König):

Lacquer according to Example	11	14
8 passages, König seconds	13	11
16 passages, König seconds	27	21

CLAIMS

1. A binder composition comprising at least one unsaturated monomer, at least one unsaturated polyester and preferably one or more crosslinking catalysts and/or crosslinking initiators and/or similar additives, whereby unsaturation within the monomer can be crosslinked with unsaturation within the polyester **characterised in**,

   a) that the monomer is

      i) an ester of at least one di, tri or polyfunctional aliphatic, cycloaliphatic or aromatic carboxylic acid or, where applicable, corresponding anhydride and at least one monofunctional aliphatic, cycloaliphatic or aromatic alcohol,

      ii) an ester of at least one linear aliphatic monofunctional carboxylic acid having more than 3 carbon atoms, a branched aliphatic monofunctional carboxylic acid having more than 4 carbon atoms, a cycloaliphatic or aromatic monofunctional carboxylic acid and at least one mono, di, tri or polyfunctional aliphatic, cycloaliphatic or aromatic alcohol,

      iii) an ester of a linear aliphatic monofunctional carboxylic acid having more than 3 carbon atoms, a branched aliphatic monofunctional carboxylic acid having more than 4 carbon atoms, a cycloaliphatic or aromatic monofunctional carboxylic acid and a monofunctional aliphatic, cycloaliphatic or aromatic alcohol,

      iv) a carboxyfunctional allyl ether or an ester thereof,

      v) an adduct between at least one carboxyfunctional compound according to (i) or (iv) and at least one di, tri or polyfunctional aliphatic, cycloaliphatic or aromatic alcohol, and/or

      vi) an adduct between at least one hydroxyfunctional compound according to (ii) or (iv) and at least one di, tri or polyfunctional aliphatic, cycloaliphatic or aromatic carboxylic acid or, where applicable, corresponding anhydride,

      whereby the unsaturation within the monomer is derived from a carboxylic acid, an anhydride, an allyl ether and/or an alcohol;

      and

   b) that the polyester is a dendritic or hyperbranched macromolecule comprising a nucleus having at least one reactive hydroxyl or epoxide group to which 1-100, preferably 1-20, generations of at least one monomeric or polymeric chain extender having at least two reactive hydroxyl groups and at least one reactive carboxyl group, are added,

whereby a hyperbranched or dendritic macromolecule wherein terminal groups substantially are hydroxyl groups is yielded, which macromolecule completely or partially in one or more steps is chain terminated

i) by at least one chain terminator being a carboxyfunctional unsaturated ester of at least one di, tri or polyfunctional carboxylic acid or, where applicable, corresponding anhydride and at least one monofunctional alcohol, and/or

ii) by a complete or partial allylation of the terminal hydroxyl groups of the macromolecule and optionally

iii) by at least one chain terminator being a monofunctional saturated or unsaturated carboxylic acid or, where applicable, corresponding anhydride,

whereby the unsaturation within the polyester completely or partially is derived from the chain termination.

2. A binder composition according to claim 1 **c h a r a c t e r i s e d i n**, that the monomer is of general formula

$(R_1 - O - R_4)_n - R_2 - (R_4 - O - R_3)_m$

wherein n and m independently is 1, 2 or 3 and wherein R_1 is hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof, R_2 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof, R_3 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof and

wherein R_4 is $\overset{\displaystyle O}{\overset{\|}{C}}$ or $\underset{\displaystyle H}{\overset{\displaystyle H}{C}}$

whereby at least one substituent R_1, R_2 or R_3 comprises at least one aliphatic double bond.

3. A binder composition according to claim 2 **c h a r a c t e r i s e d i n**, that R_4 is $\overset{\displaystyle O}{\overset{\|}{C}}$ and R_2 is carboxysubstituted alkyl, alkenyl alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof.

4. A binder composition according to claim 3
characterised in, that
R_1 is hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched and/or hydroxysubstituted variations thereof

R_3 is $R_5 - O - \overset{O}{\overset{\|}{C}} - R_6 - \overset{O}{\overset{\|}{C}} - O - R_7$ wherein R_5 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof, R_6 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched and/or hydroxysubstituted variations thereof and R_7 is hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof.

5. A binder composition according to claim 2
characterised in, that
R_4 is CH_2 and R_2 is hydroxysubstituted alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched and/or carboxysubstituted variations thereof.

6. A binder composition according to claim 5
characterised in, that
R_1 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched and/or carboxysubstituted variations thereof, R_3 is $R_5 - O - CH_2 - R_6 - CH_2 - O - R_7$ wherein R_5 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof, R_6 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched and/or carboxysubstituted variations thereof and R_7 is hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof.

7. A binder composition according to claim 1
characterised in, that
the monomer is an ester of maleic acid, maleic anhydride or fumaric acid and trimethylolpropane diallyl ether or pentaerythritol triallyl ether at a molar ratio acid or anhydride to alcohol of 1:0.8 to 1:2.2.

8. A binder composition according to claim 1
c h a r a c t e r i s e d i n, that
the monomer is an ester of succinic acid or succinic anhydride and trimethylolpropane diallyl ether or pentaerythritol triallyl ether at a molar ratio acid or anhydride to alcohol of 1:0.8 to 1:2.2.

9. A binder composition according to claim 1
c h a r a c t e r i s e d i n, that
the monomer is an ester of maleic acid, maleic anhydride or fumaric acid and 5-methyl-1,3-dioxane-5-methanol or 5-ethyl-1,3-dioxane-5-methanol at a molar ratio acid or anhydride to alcohol of 1:0.8 to 1:2.2.

10. A binder composition according to claim 1
c h a r a c t e r i s e d i n, that
the monomer is an ester of propionic acid, acetic acid, crotonic acid, caprylic acid or capric acid and trimethylolpropane diallyl ether or pentaerythritol triallyl ether at a molar ratio acid to alcohol of 1:0.8 to 1:2.2.

11. A binder composition according to claim 1
c h a r a c t e r i s e d i n, that
the monomer is an ester of crotonic acid and 5-methyl-1,3-dioxane-5-methanol or 5-ethyl-1,3-dioxane-5-methanol at a molar ratio acid to alcohol of 1:0.8 to 1:2.2.

12. A binder composition according to claim 1
c h a r a c t e r i s e d i n, that
the monomer is an adduct between

a) a monoester of maleic acid, maleic anhydride or fumaric acid and an aliphatic monofunctional alcohol,
and

b) a diol

at a molar ratio ester to diol of 0.8:1 to 2.2:1.

13. A binder composition according to claim 12
c h a r a c t e r i s e d i n, that

a) the alcohol is methanol, ethanol, propanol and/or butanol
and

b) the diol is ethylene glycol, propylene glycol, butylene glycol, neopentyl glycol, 2-methyl-1,3-propanediol, 2-ethyl-2-butyl-1,3-propanediol, cyclohexanedimethanol, 1,3-dioxane-5,5-dimethanol, trimethylolpropane monoallyl ether and/or phenylethylene glycol.

14. A binder composition according to claim 1
characterised in, that
the monomer is an adduct between
a) a monoester of maleic acid, maleic anhydride or fumaric acid and an aliphatic monofunctional alcohol,
b) a diol,
and
c) a monofunctional carboxylic acid

at a molar ratio ester to diol to acid of 1:0.8:0.8 to 1:1.2:1.2.

15. A binder composition according to claim 14
characterised in, that
a) the alcohol is methanol, ethanol, propanol and/or butanol,
b) the diol is ethylene glycol, propylene glycol, butylene glycol, neopentyl glycol, 2-methyl-1,3-propanediol, 2-ethyl-2-butyl-1,3-propanediol, cyclohexanedimethanol, 1,3-dioxane-5,5-dimethanol, trimethylolpropane monoallyl ether and/or phenylethylene glycol,
and
c) the carboxylic acid is crotonic acid, caprylic acid, capric acid, propionic acid and/or acetic acid.

16. A binder composition according to claim 1
characterised in, that
the monomer is 2,2-dimethylpropionic acid monoallyl ether or 2,2-dimethylolpropionic acid diallyl ether and/or an ester thereof with trimethylolpropane diallyl ether and/or pentaerythritol triallyl ether at a molar ration of 1:0.8 to 1:1.2.

17. A binder composition according to claim 1
characterised in, that
the monomer is an ester of 2,2-dimethylolpropionic acid monoallyl ether or 2,2-dimethylolpropionic diallyl ether and a diol at a molar ratio of 0.8:1 to 2.2:1.

18. A binder composition according to claim 17
characterised in, that
the diol is ethylene glycol, propylene glycol, butylene glycol, neopentyl glycol, 2-methyl-1,3-propanediol, 2-ethyl-2-butyl-1,3-propanediol, cyclohexanedimethanol, 1,3-dioxane-5,5-dimethanol, trimethylolpropane monoallyl ether and/or phenylethylene glycol.

19. A binder composition according to any of the claims 1-18
characterised in, that
the monomer has a molecular weight being less than or equal to 1000

20. A binder composition according to any of the claims 1-19
characterised in, that
the monomer constitutes 20-90, preferably 40-70, per cent by weight of the binder composition.

21. A binder composition according to claim 1
characterised in, that
the polyester is chain terminated by a chain terminating ester of general formula

$$HO - \overset{\overset{\displaystyle O}{\|}}{C} - R_1 - \overset{\overset{\displaystyle O}{\|}}{C} - O - R_2$$

wherein R_1 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched and/or carboxysubstituted variations thereof and wherein R_2 is alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, alkylaryl, alkenylaryl, alkynylaryl and/or branched variations thereof, whereby at least one substituent R_1 or R_2 comprises at least one aliphatic double bond.

22. A binder composition according to claim 1 or 21
characterised in, that
the chain terminating ester is an ester of maleic acid, maleic anhydride or fumaric acid and 5-methyl-1,3-dioxane-5-methanol or 5-ethyl-1,3-dioxane-5-methanol at a molar ratio acid or anhydride to alcohol of 1:0.8 to 1:1.2

23. A binder composition according to claim 1 or 21
characterised in, that
the chain terminating ester is an ester of maleic acid, maleic anhydride or fumaric acid and trimethylolpropane diallyl ether or pentaerythritol triallyl ether at a molar ratio acid or anhydride to alcohol of 1:0.8 to 1:1.2.

24. A binder composition according to claim 1 or 21
characterised in, that
the chain terminating ester is an ester of succinic or succinic anhydride and trimethylolpropane diallyl ether or pentaerythritol triallyl ether at a molar ratio acid or anhydride to alcohol of 1:0.8 to 1:1.2.

25. A binder composition according to claim 1 or 21
c h a r a c t e r i s e d i n, that
the chain terminating ester is an ester of maleic acid, maleic anhydride or fumaric acid and methanol, ethanol, propanol or butanol at a molar ratio acid or anhydride to alcohol of 1:0.8 to 1:1.2.

26. A binder composition according to claim 1
c h a r a c t e r i s e d i n, that
the polyester is chain terminated by a complete or partial allylation of the terminal hydroxyl groups by reaction with an allylhalid.

27. A binder composition according to claim 26
c h a r a c t e r i s e d i n, that
the allylhalid is allylchloride and/or allylbromide.

28. A binder composition according to claim 1
c h a r a c t e r i s e d i n, that
the polyester is chain terminated by at least one chain terminator being a monofunctional carboxylic acid, whereby the carboxylic acid is acetic acid, propionic acid, butyric acid, isobutyric acid, valeric acid, trimethylacetic acid, crotonic acid, acrylic acid, methacrylic acid, benzoic acid, para-tert.butylbenzoic acid, capric acid, caprylic acid, caproic acid, heptanoic acid, 2-ethylhexanoic acid, pelargonic acid, isononanoic acid, lauric acid, myristic acid, palmitic acid, stearic acid, isostearic acid, behenic acid, lignoceric acid, montanoic acid, sorbic acid, abietic acid, oleic acid, ricinoleic acid, linoic, linoleic acid, soybean fatty acid, linseed fatty acid, dehydrated castor fatty acid, tall oil fatty acid, tung oil fatty acid, sunflower fatty acid, safflower fatty acid and/or 2,2-dimethylolpropionic acid diallyl ether.

29. A binder composition according to claim 1
c h a r a c t e r i s e d i n, that
the binder composition comprises one or more crosslinking catalysts and/or crosslinking initiators being

a) benzoephenones such as alkyl and haloalkylbenzoephenones,
b) antraquinones such as nitroantraquinones, antrahydroquinones and derivatives thereof,
c) benzoin and derivatives thereof,
d) acetophenone and derivatives thereof,
e) acyloxime esters and derivatives thereof,
f) benzil ketals and derivatives thereof,

g) peroxides such as hydrogen peroxide, methylethylketone peroxide, methylisobutylketone peroxide, cumenhydroperoxide and benzoyl peroxide,
h) metal salts such as octoates, naphthenates and oleates of cobalt and manganese,
i) perbenzoates such as alkylperbenzoates,
j) cathecols such as alkylcathecols, and/or
k) phenylamines such as aniline, alkylanilines, toluidine and alkyltoluidines.

30. A binder composition according to claim 1 or 29
characterised in, that
one or more crosslinking catalysts and/or crosslinking initiators are included, each in an amount of 0.1-15, preferably 1-10, per cent by weight calculated on included polyester.

31. A binder composition according to any of the claims 1-30
characterised in, that
it constitutes 1-100, preferably 20-100 and most preferably 50-100, per cent by weight of an air drying, heat curing or radiation curing paint or lacquer intended for industrial surface treatment of paper, wood, plastics and/or steel, such as a printing ink, furniture coating, an automotive coating, a coating for domestic appliances or a microlithographic resist/coating.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 95/01218

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: C09D 167/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: C09D, C08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CAPLUS, EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9318079 A1 (DSM N.V.), 16 Sept 1993 (16.09.93) --	1-31
A	WO 9317060 A1 (PERSTORP AB), 2 Sept 1993 (02.09.93) -- --------	1-31

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" ertier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 January 1996	03 -02- 1996
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Sofia Nikolopoulou Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

05/01/96

International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 9318079	16/09/93	CN-A- 1076702	29/09/93
		NL-A- 9200416	01/10/93
WO-A1- 9317060	02/09/93	AU-A- 3653093	13/09/93
		CA-A- 2117486	02/09/93
		EP-A- 0597042	18/05/94
		EP-A- 0630389	28/12/94
		JP-T- 6507512	25/08/94
		JP-T- 7504219	11/05/95
		SE-B,C- 468771	15/03/93
		SE-A- 9200564	15/03/93
		US-A- 5378886	03/01/95
		US-A- 5418301	23/05/95